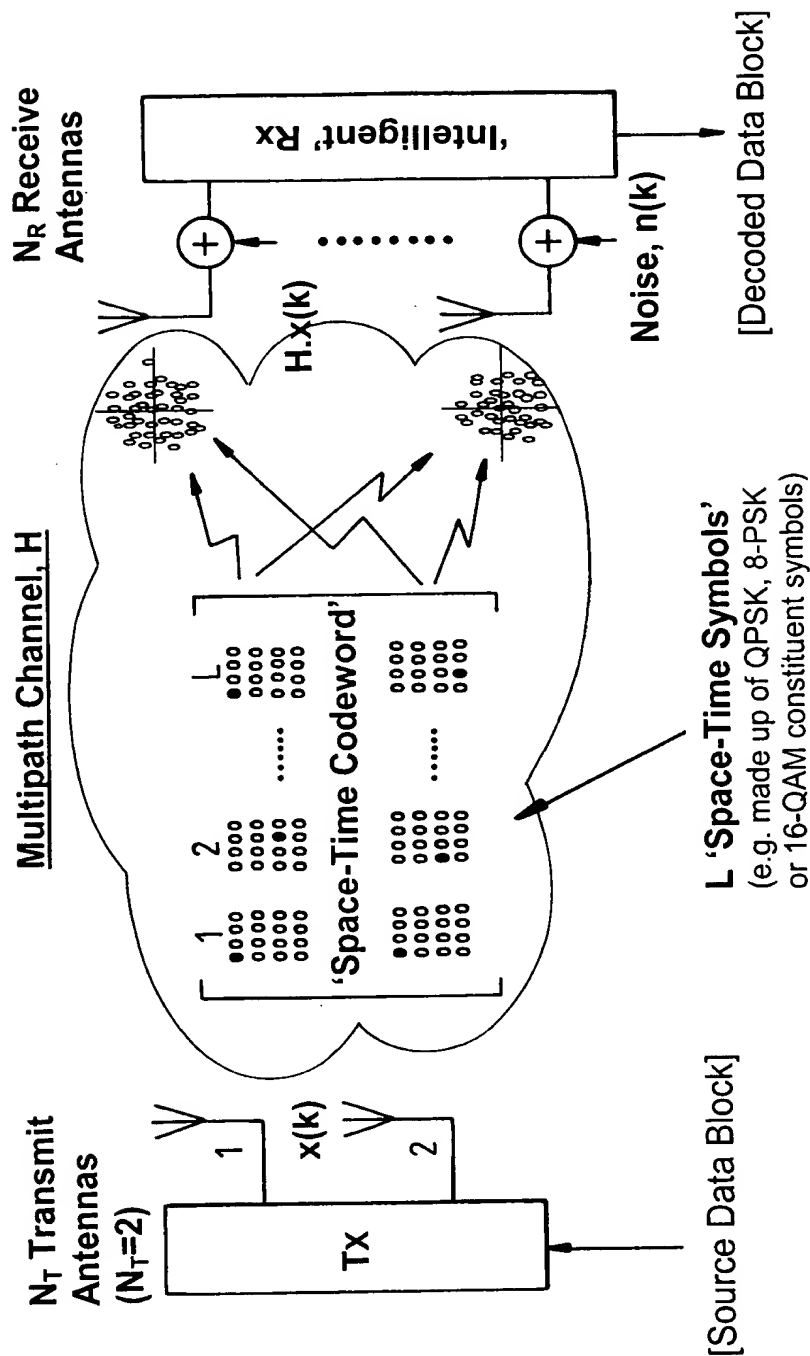


Fig. 1

Space-Time Coding System Model



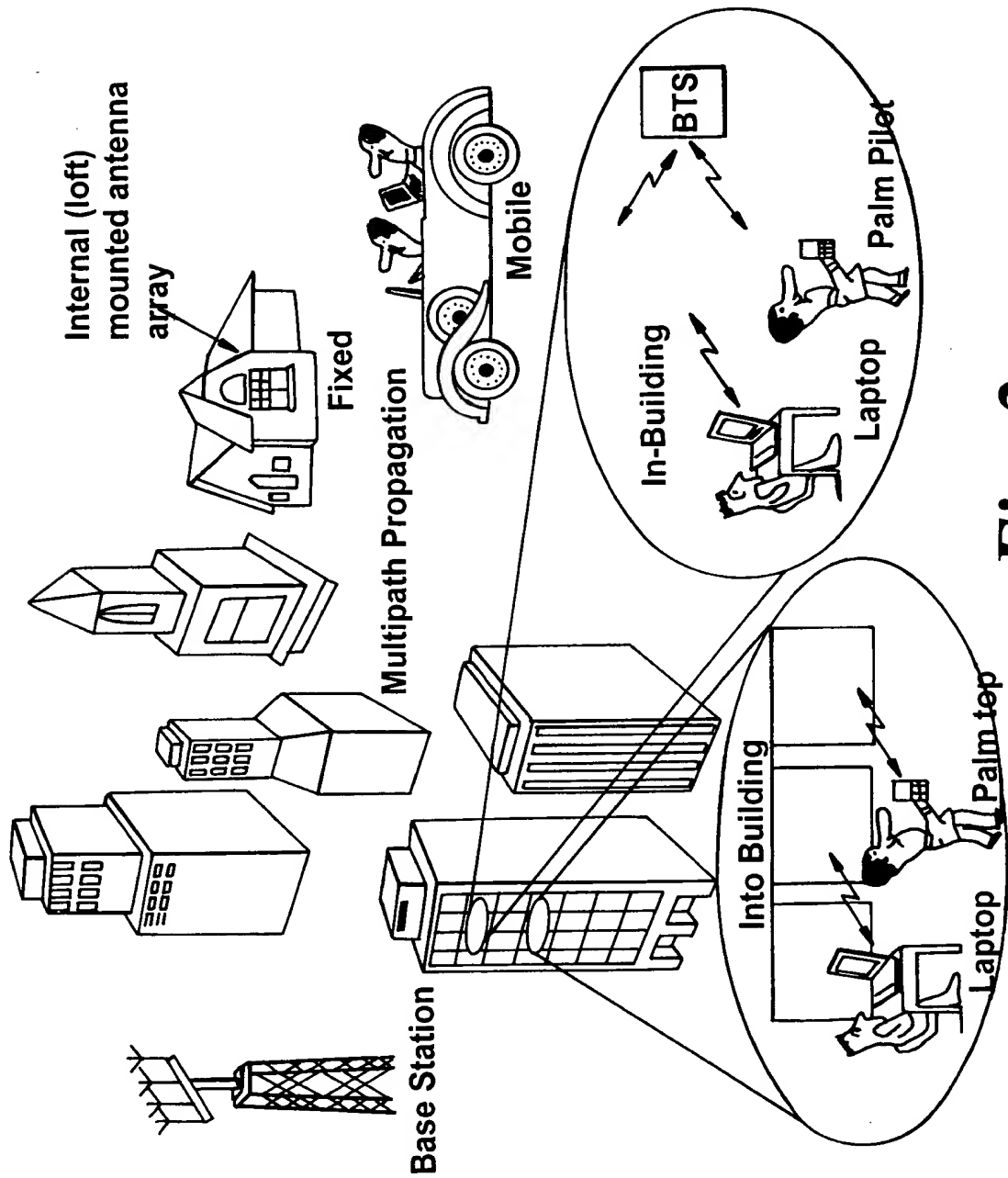
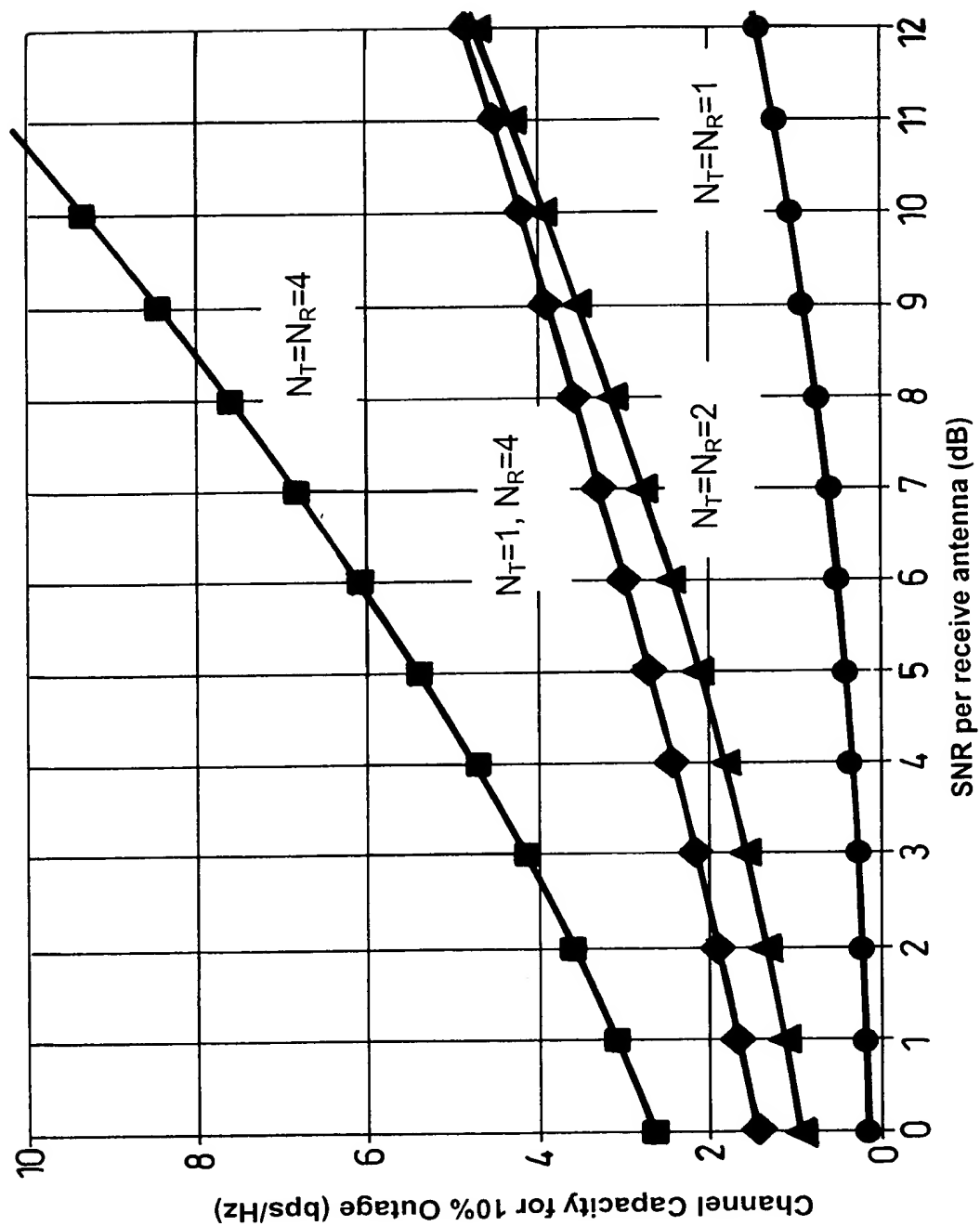
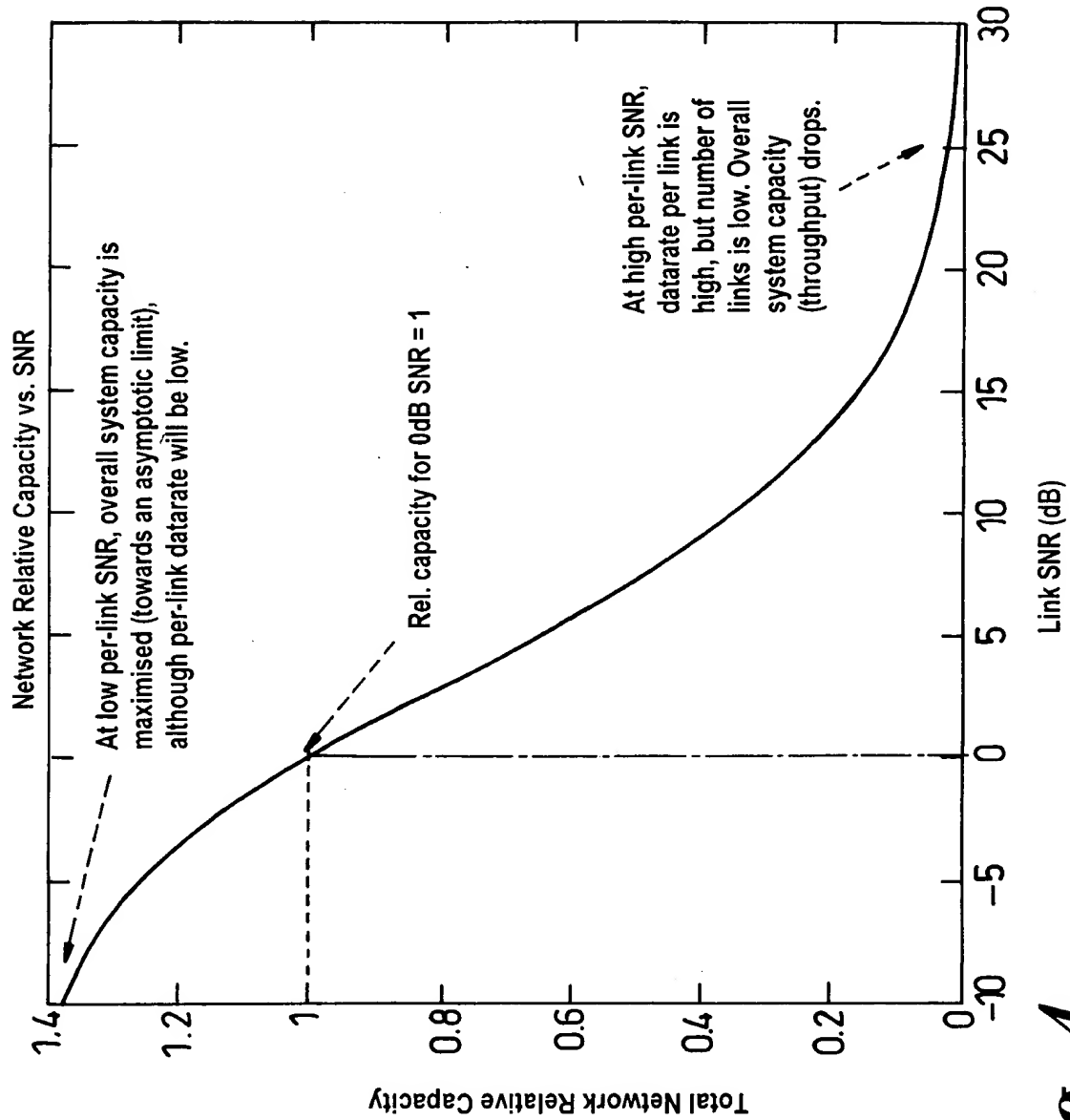


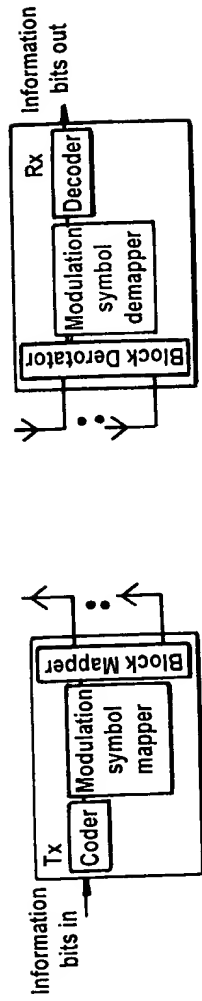
Fig. 2

*Fig. 3*

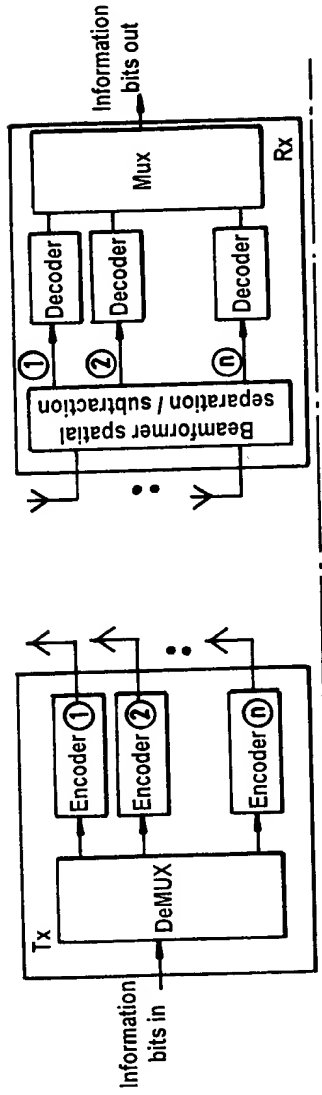
**Fig. 4**

STC Techniques

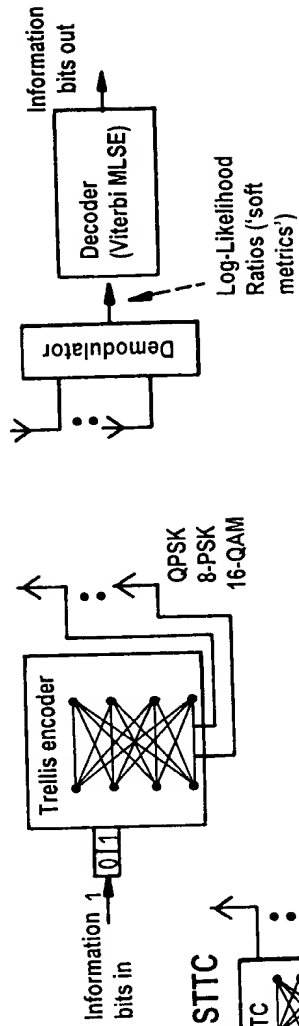
(i) Space-Time Block Coding (STBC)



(ii) Layered Space-Time (BLAST)



(iii) Space-Time Trellis Coding (STTC)



(iv) Serially-Concatenated STTC

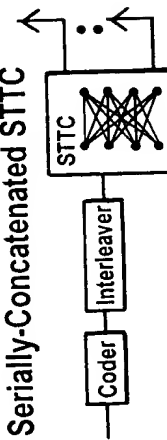


Fig. 5

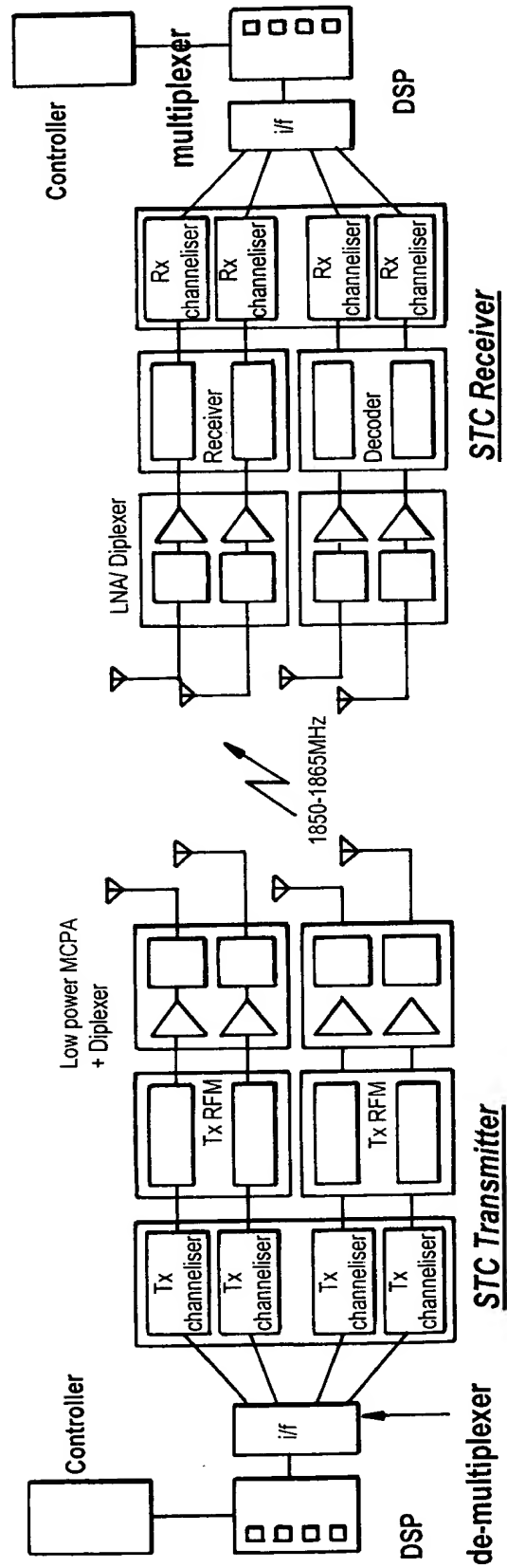


Fig. 6

900

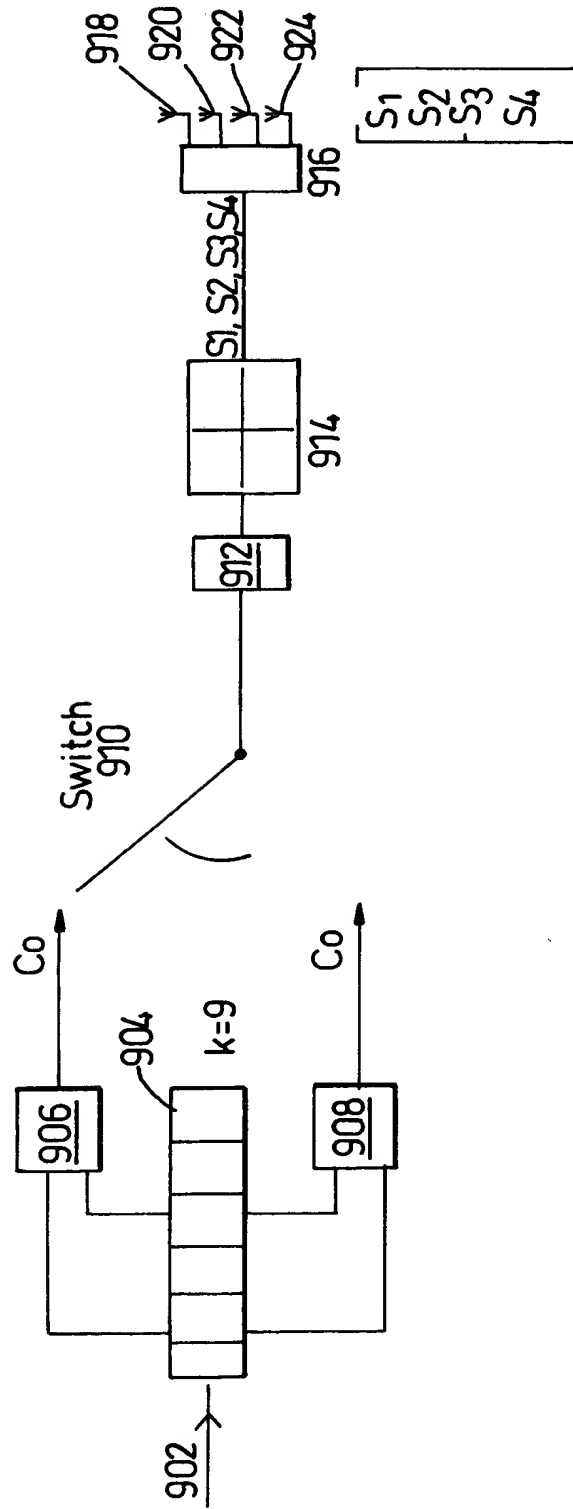


Fig. 7

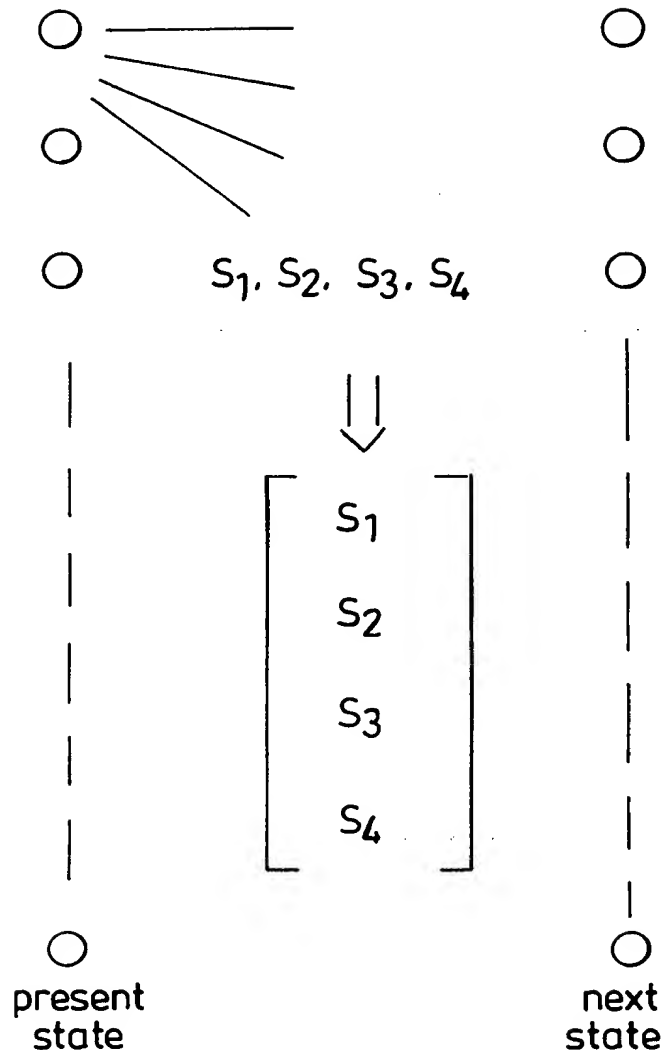


Fig. 8

SC-STTC Coder

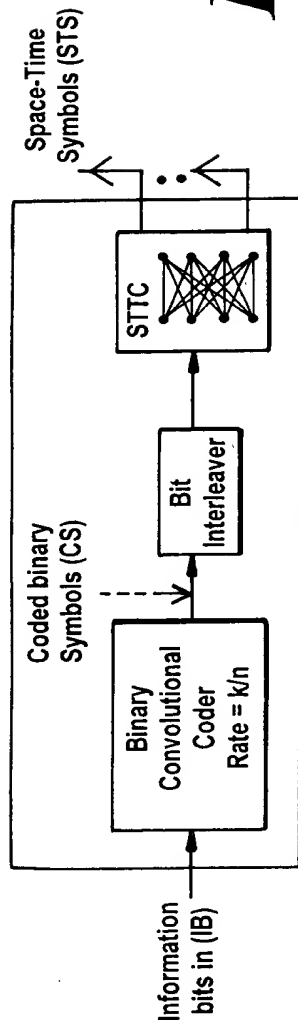
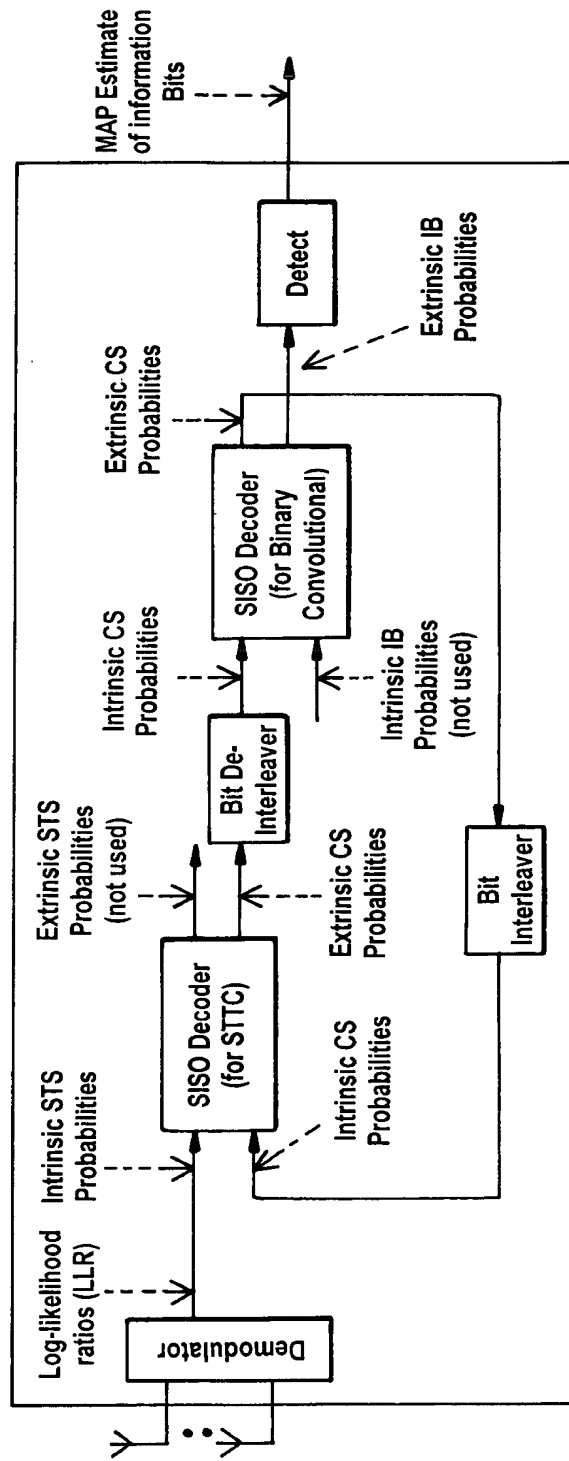


Fig. 9

SC-STTC Decoder



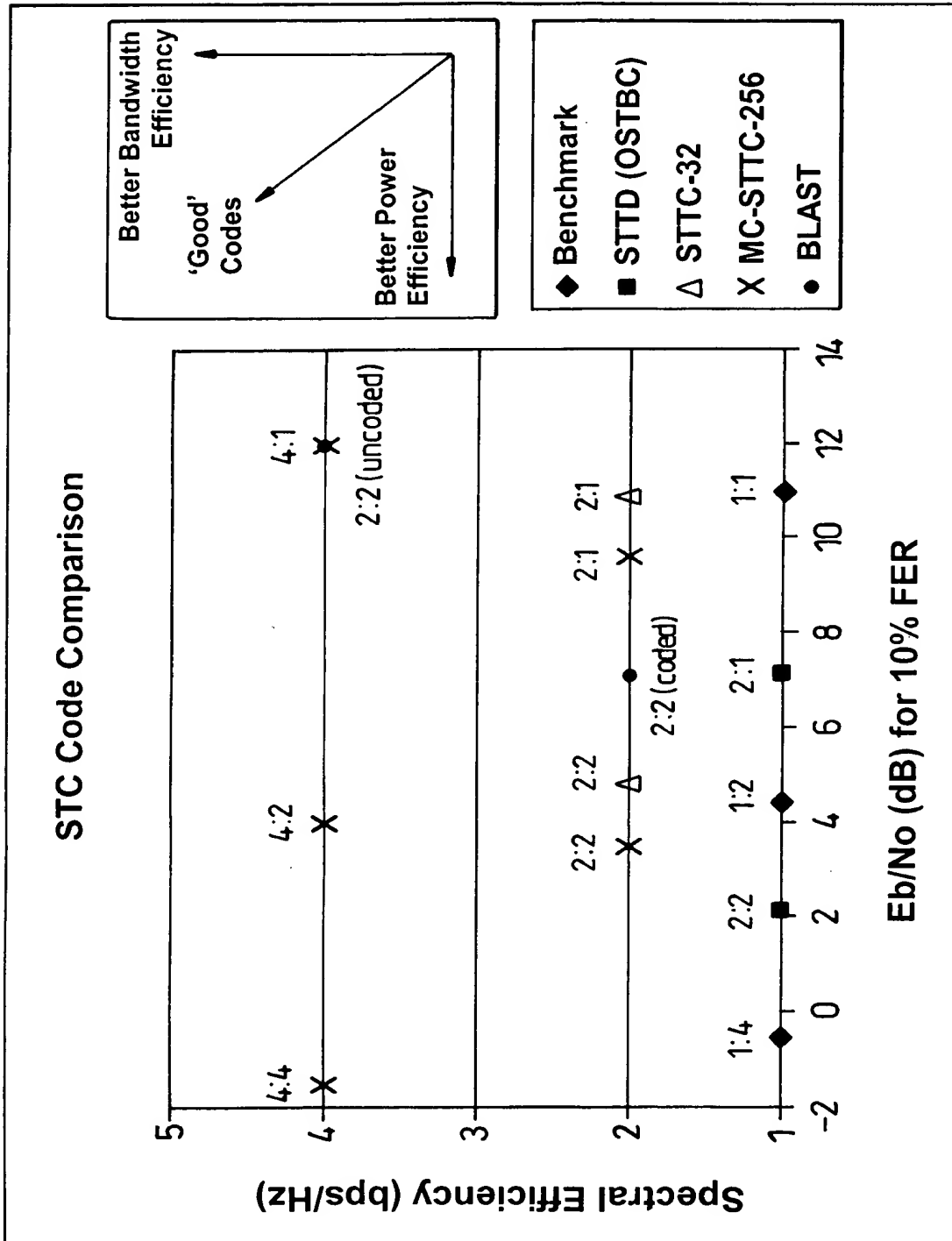


Fig. 10

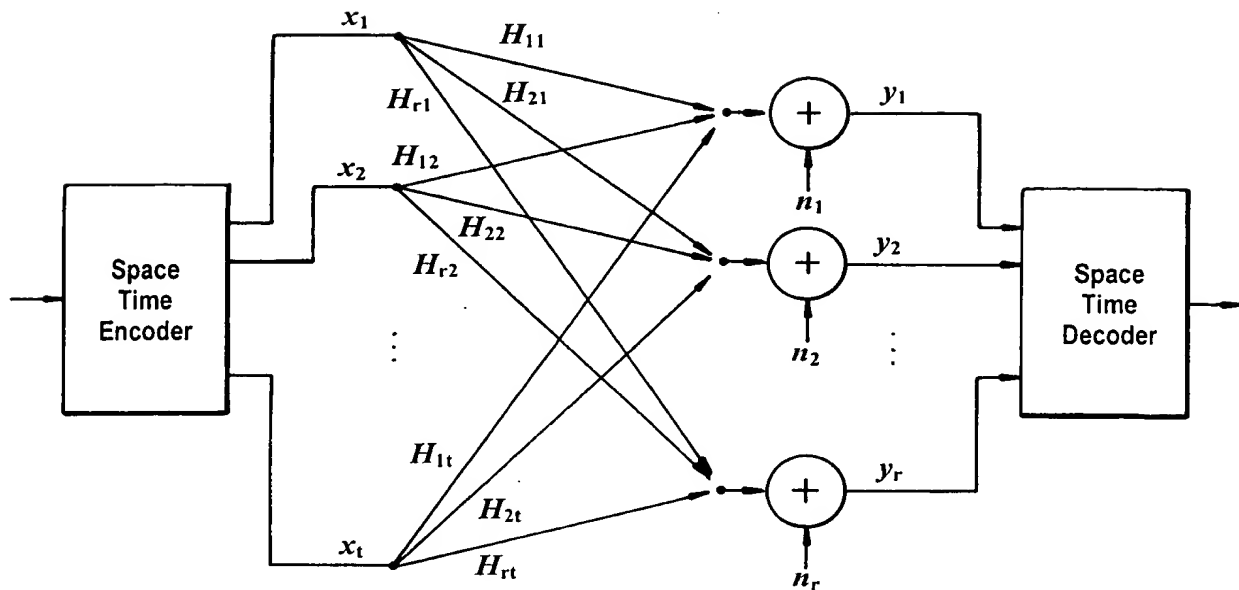


Fig. 11

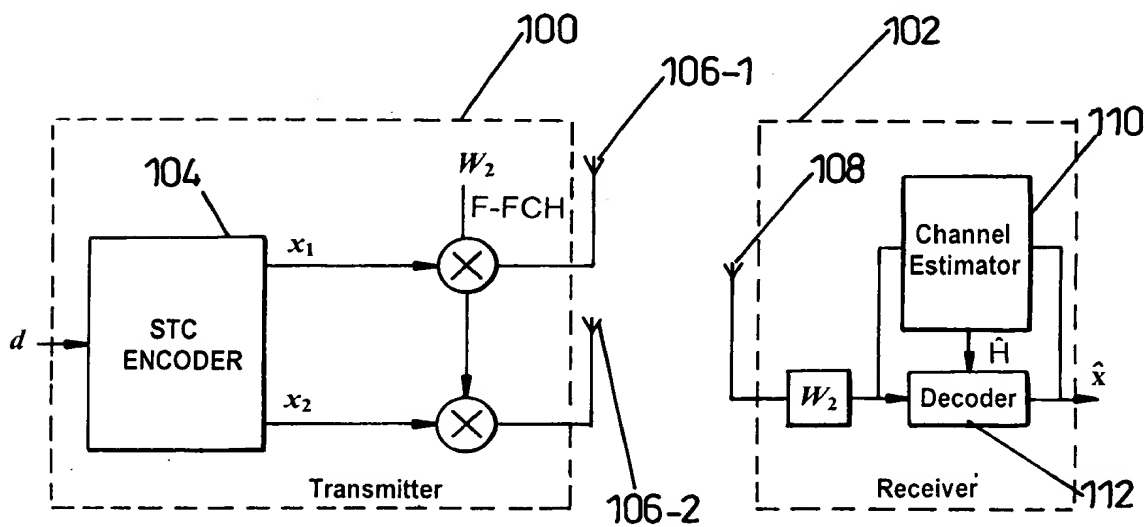
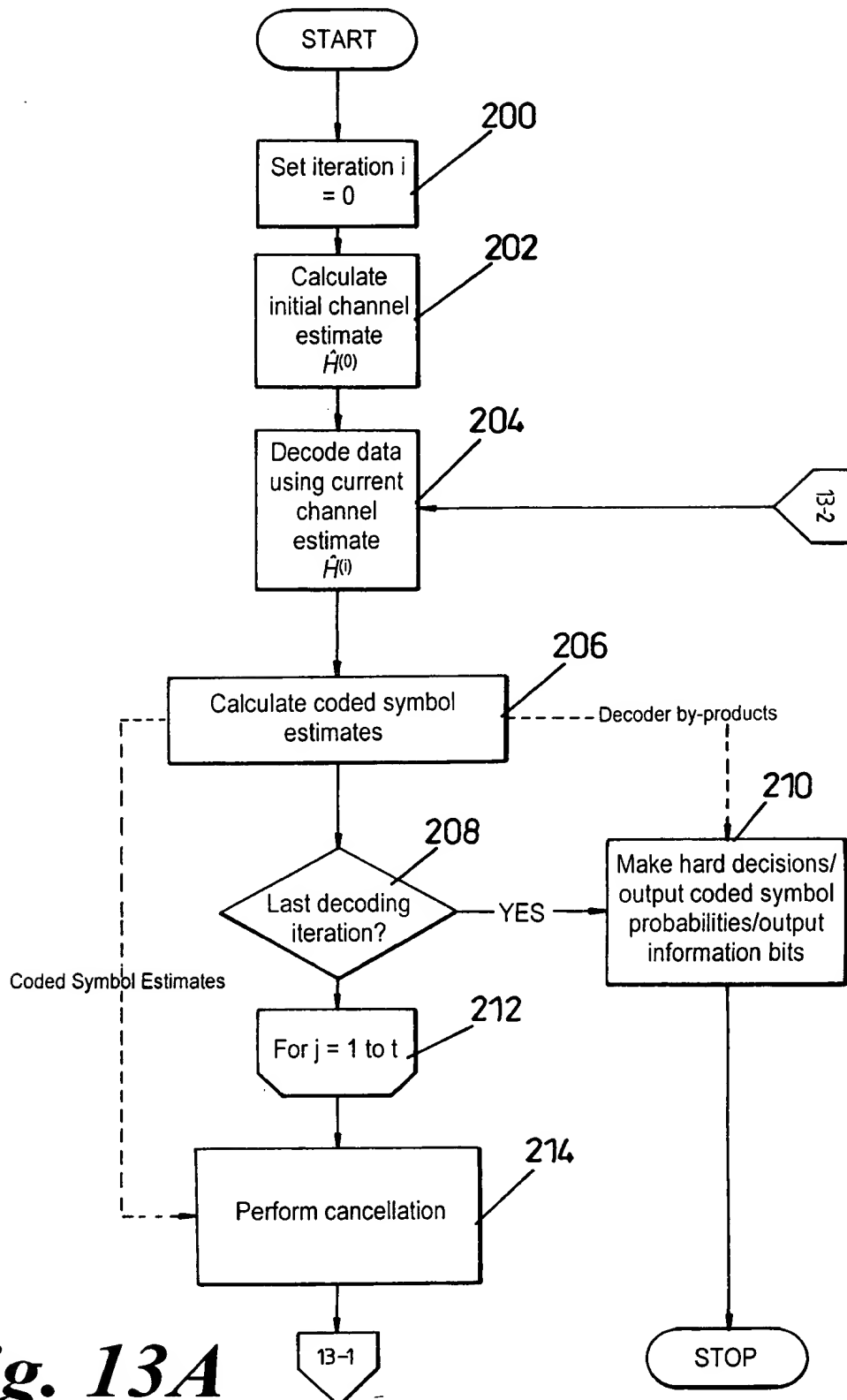
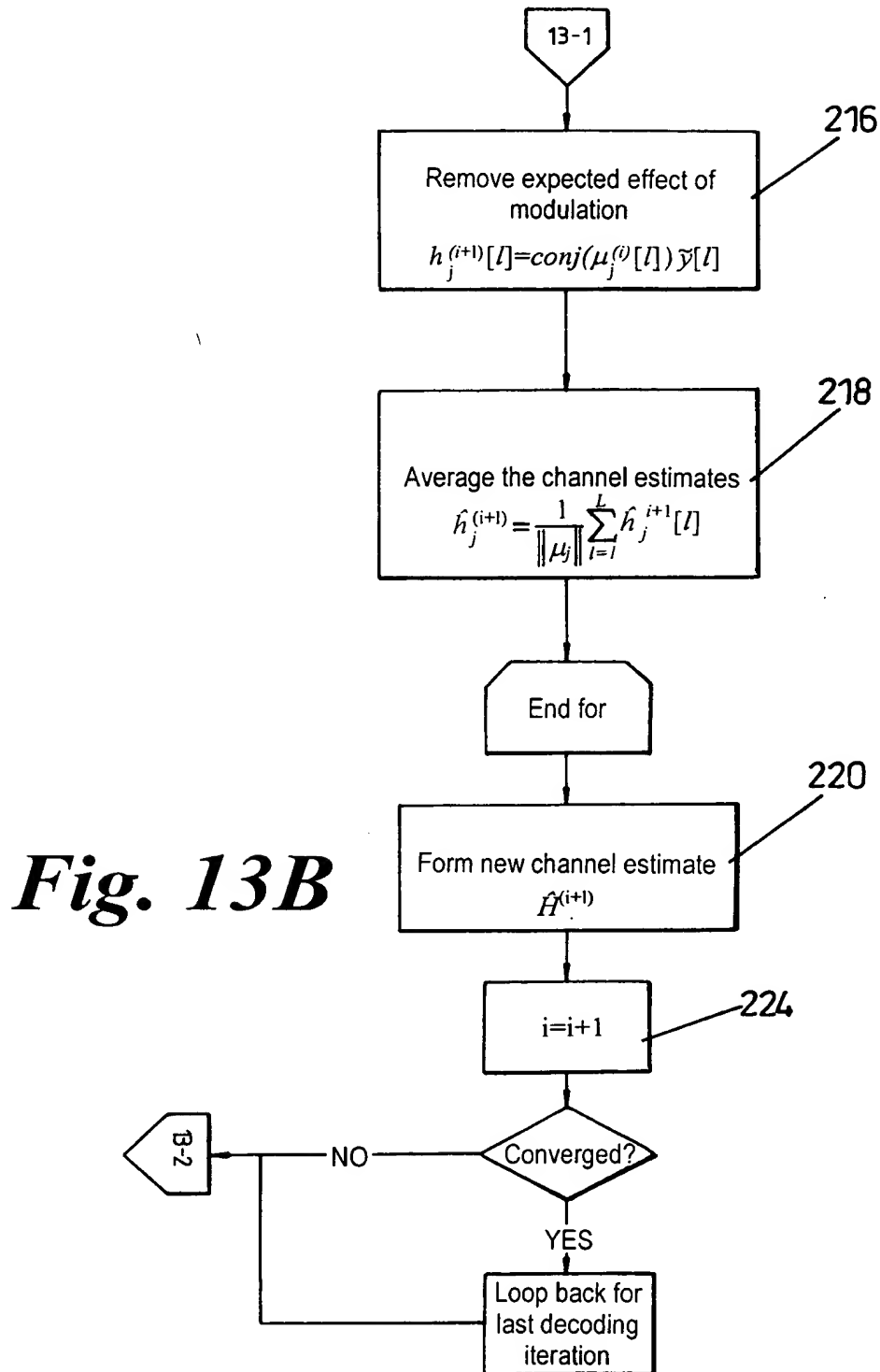
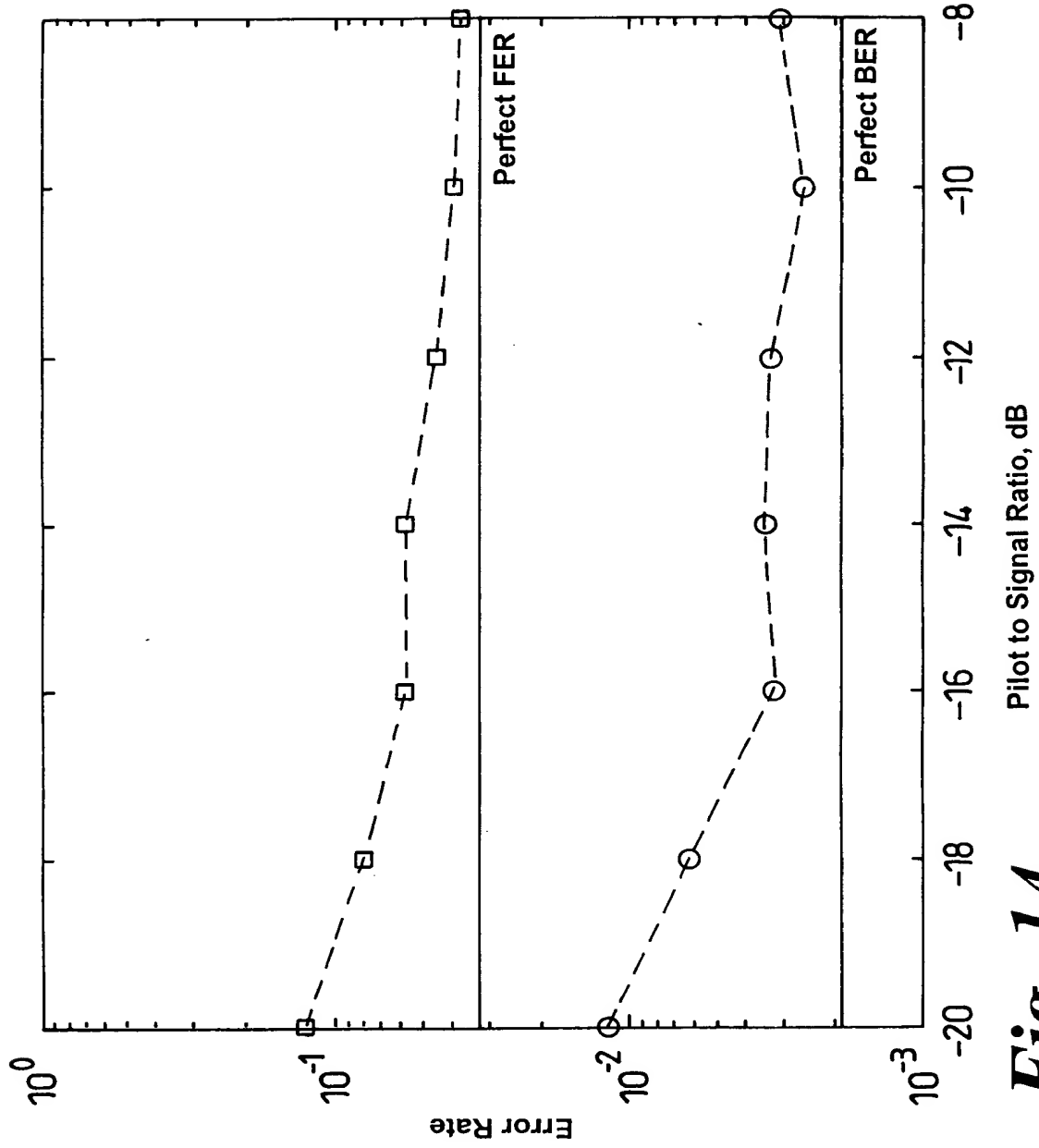
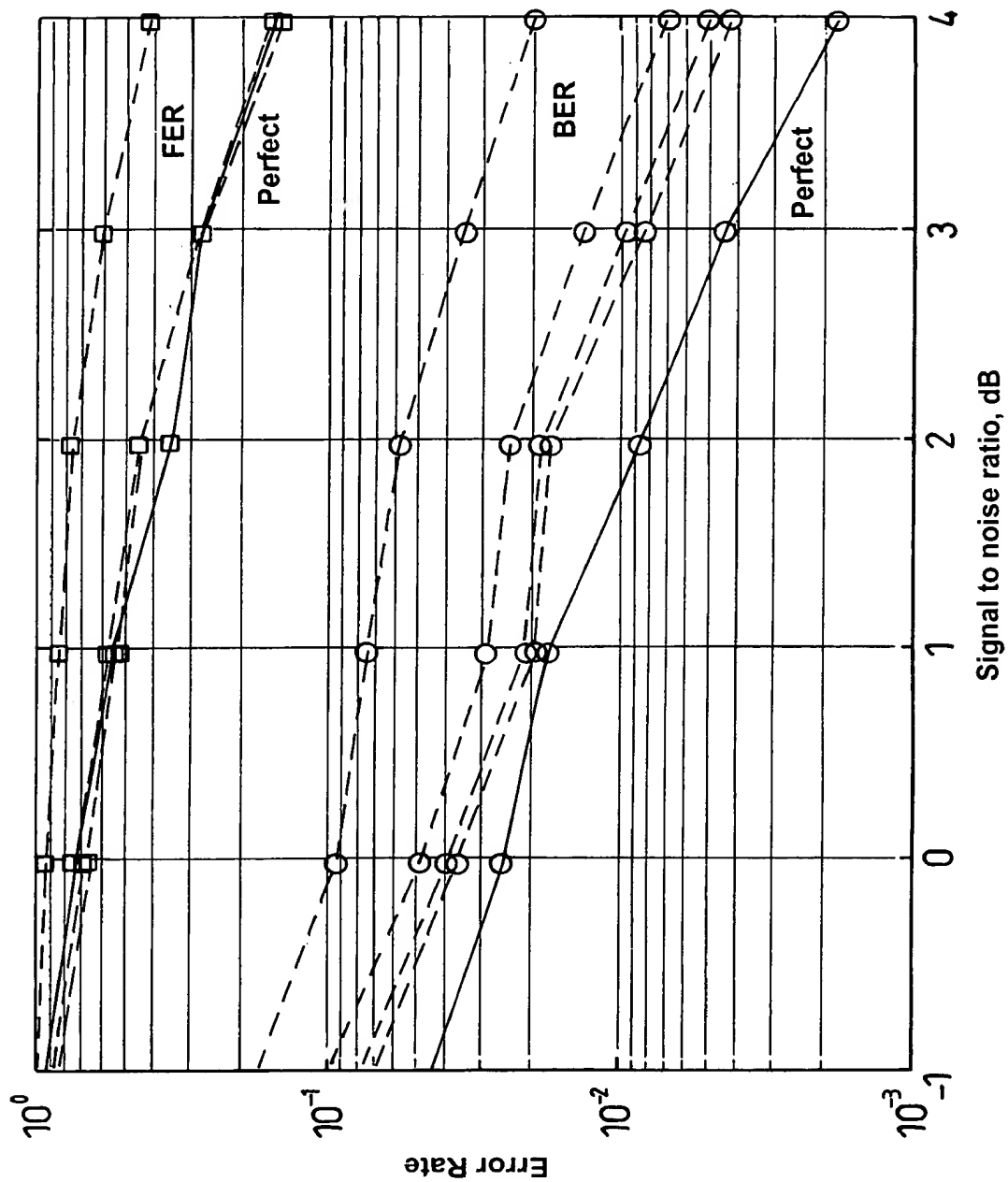


Fig. 12

**Fig. 13A**



**Fig. 14**

*Fig. 15*

Constraint length K	Generators in octal	
3	5	7
4	15	17
5	23	35
6	53	75
7	113	171
8	247	371
9	561	753
10	1,167	1,545
11	2,335	3,661
12	4,335	5,723
13	10,533	17,661
14	21,675	27,123

Fig. 16



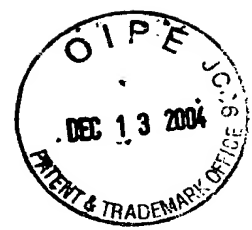
REPLACEMENT SHEET

STC-Algorithm ($N_T:N_R$)	E_b/N_o dB for 10% FER	Spectral Efficiency (bps/Hz)	E_s/N_o (SNR) dB for 10% FER
Benchmark			
1:1	11.0	1.0	11.0
1:2	4.5	1.0	4.5
1:4	-0.5	1.0	-0.5
STTD (STBC)			
2:1	7.2	1.0	7.2
2:2	2.2	1.0	2.2
STTC-32			
2:1	11.0	2.0	14.0
2:2	4.6	2.0	7.6
MC-STTC-256			
2:1	9.6	2.0	12.6
2:2	3.5	2.0	6.5
4:1	12.0	4.0	18.0
4:2	4.0	4.0	10.0
4:4	-1.5	4.0	4.5
BLAST			
uncoded 2:2	12.0	4.0	18.0
coded 2:2	7.1	2.0	10.1

Fig.17

Notes: Notation $N_T:N_R$ is used to denote numbers of antennas at each end of the link.

- E_s denotes energy per transmitted STS
- The benchmark is a 1/2-rate $k=9$ binary convolutional encoder, with output bits mapped to QPSK symbols. In a *static* 1:1 channel it achieves 10% FER for an E_b/N_o of 2.2dB and 1% BER for an E_b/N_o of 1.7dB.
- The benchmark 1:4 number is approximate, as it has been extrapolated from results at a lower FER
- 'STTD' is a concatenation of the benchmark encoder with the STTD block code
- 'STTC-32' is the Tarokh STTC with 32 states, and two information bits per STS
- 'MC-STTC-256' is a concatenation of the benchmark scheme, a QPSK modulation mapper, and a demux mapper to the different transmit antennas. It thus has $2^{k-1}=256$ states in the trellis, and a spectral efficiency which depends on the number of transmit antennas.
- The variants of BLAST shown in the table use 'genie-aided' subtraction of the transmission from the stronger transmit antenna when detecting the transmission from the weaker.
- The 'uncoded' BLAST case uses no error correction code (it is raw QPSK), hence it achieves a high spectral efficiency of 4 bps/Hz. The 'coded' case uses two separate 'benchmark' encoders, one for each antenna.



REPLACEMENT SHEET

STC-Algorithm ($N_T:N_R$)	Spectral efficiency (bps/Hz)	Demodulator soft-metric (LLR) processing (MFLOPS)	Viterbi MLSE processing (MFLOPS)
Benchmark			
1:1	1	0.9	198.4
1:2	1	2.5	198.4
1:4	1	5.0	198.4
STTD (STBC)			
2:1	1	2.5	198.4
2:2	1	5.0	198.4
STTC-32			
2:1	2	8.7	12.4
2:2	2	17.4	12.4
MC-STTC-256			
2:1	2	8.7	99.2
2:2	2	17.4	99.2
4:1	4	69.4	168.6
4:2	4	138.9	168.6
4:4	4	277.8	168.6
8:8	8	71,198	1276.4
BLAST (coded)			
2:2	2	$0.02+2.5+1.2=3.7$	198.4
4:4	4	$0.7+5.0+3.7=9.4$	198.4
8:8	8	$24.8+9.9+8.7=43.4$	198.4

Fig. 18